ENGINEERING TEST REPORT

SG-Sure Signal
Model No.: SURE SIGNAL, SURE SIGNAL MAX & SURE SIGNAL CSR
FCC ID: PED-SURESIGNAL

Applicant: **Sur-Gard Security Systems Ltd.**
3301 Langstaff Road
Concord, Ontario
Canada, L4K 4L2

Tested in Accordance With

Federal Communications Commission (FCC)
CFR 47, PARTS 2 and 90 (Subpart I)

UltraTech's File No.: SSS24-FTX

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: February 12, 2001	
Report Prepared by: Dan Huynh Issued Date: February 8, 2001	Tested by: Mr Hung Trinh, RFI/EMI Technician Test Dates: January 8, 2001

The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.

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EXHIBIT 1. SUBMITTAL CHECK LIST

Exhibit No.	Exhibit Type	Description of Contents	Quality Check (OK)
1 through 8	Test Report	• Exhibit 1: Submittal check lists • Exhibit 2: Introduction • Exhibit 3: Performance Assessment • Exhibit 4: EUT Operation and Configuration during Tests • Exhibit 5: Summary of test Results • Exhibit 6: Measurement Data • Exhibit 7: Measurement Uncertainty • Exhibit 8: Measurement Methods	OK
9	Test Setup Photos	Radiated Emissions Test Setup	OK
10	External Photos of EUT	External SG-Sure Signal Photos	OK
11	Internal Photos of EUT	Internal SG-Sure Signal Photos	OK
12	Cover Letters	• Letter from Ultratech for Certification Request • Letter from the Applicant to appoint Ultratech to act as an agent	OK
13	ID Label/Location Info	• ID Label • Location of ID Label	OK
14	Block Diagram	SG-Sure Signal Block Diagram	OK
15	Schematics	• PCB • SG-Sure Signal Schematic	OK
16	Users Manual	Installation manual for Sure Signal, Sure Signal Max and Sure Signal CSR	OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Parts 2 and 90 (Subpart 90)
Title	Telecommunication - Code of Federal Regulations, CFR 47, Parts 2 & 90
Purpose of Test:	To gain FCC Certification Authorization for Radio operating in the frequency band 896-901 MHz.
Test Procedures	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

2.2. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	1998	Code of Federal Regulations – Telecommunication
ANSI C63.4	1992	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 & EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1		Specification for Radio Disturbance and Immunity measuring apparatus and methods

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Sur-Gard Security Systems Ltd.
Address:	3301 Langstaff Road Concord, Ontario Canada, L4K 4L2
Contact Person:	Mr. Dan Nita Phone #: 905-760-3000 (2706) Fax #: 905-760-3020 Email Address: nitad@sur-gard.com

MANUFACTURER	
Name:	Sur-Gard Security Systems Ltd.
Address:	401 Magnetic Drive, Units 24-26 Downsview, Ontario Canada M3J 3H9
Contact Person:	Mr. Dan Nita Phone #: 905-760-3000 (2706) Fax #: 905-760-3020 Email Address: nitad@sur-gard.com

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Sur-Gard Security Systems Ltd.
Product Name:	SG-Sure Signal
Model Name or Number:	Sure Signal, Sure Signal Max, Sure Signal CSR
Serial Number:	Preproduction
Type of Equipment:	Radio Communication Equipment
External Power Supply:	N/A
Transmitting/Receiving Antenna Type:	Non-integral TNC connector
Primary User Functions of EUT:	Radio alarm transmitter/receiver for fire and burglary alarm systems applications

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Base station (fixed use)
Intended Operating Environment:	Residential Commercial, light industry & heavy industry
Power Supply Requirement:	12 VDC regulated
RF Output Power Rating:	2 Watts (direct at antenna terminal) 2.3 Watts Peak ERP
Operating Frequency Range:	896-901 MHz
RF Output Impedance:	50 Ohms
Emission Designation:	12K8F1D
Digital Oscillator Frequency:	16 MHz
Radio Oscillator Frequencies:	90 MHz
Antenna Connector Type:	TNC
Antenna Description:	Manufacturer: Max Lion Corporation Type:1/4 wave Model: B-27 T Freq Range: 896-941 MHz Gain: 3dBi

3.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	RF IN/OUT Port	1	TNC	No cable. Direct connection
2	I/O Communication Bus and DC supply port	1	8 conductor terminal block	Non-shielded wire leads

3.5. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

3.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment #1	
Description:	Sur-gard Security System was used to operate run the Radio Module in an intended application. The radio frequency was changed by using a keypad connected to the Sur-gard Security System, which communicated to the Radio through the Sur-Gard Skyroute Interface Board.

EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	12 VDC regulated

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

Operating Modes:	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the test data.
Special Test Software:	None
Special Hardware Used:	None
Transmitter Test Antenna:	The EUT is tested with the transmitter antenna port terminated to a 50 Ohms RF Load.

Transmitter Test Signals	
Frequency Band: ▪ 896-901 MHz	Near lowest & near highest frequencies in each frequency band that the transmitter covers: ▪ 896 and 901 MHz
Transmitter Wanted Output Test Signals: ▪ RF Power Output (measured maximum output power): ▪ Normal Test Modulation ▪ Modulating signal source:	 ▪ 2 Watts (direct at antenna terminal) 2.3 Watts Peak ERP ▪ FM Data ▪ Internal

EXHIBIT 5. SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above site have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Sep. 20, 1999.

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	APPLICABILITY (YES/NO)
90.205 & 2.1046	RF Power Output	Yes (Note 2)
90.213 & 2.995	Frequency Stability	(Note 1)
90.242(b)(8) & 2.987(a)	Audio Frequency Response	N/A for Data
90.210 & 2.987(b)	Modulation Limiting	(Note 1)
90.209, 90.210 & 2.989	Emission Limitation & Emission Masks	(Note 1)
90.210, 2.997 & 2.991	Emission Limits - Spurious Emissions at Antenna Terminal	(Note 1)
90.210, 2.997 & 2.993	Emission Limits - Field Strength of Spurious Emissions	Yes (Note 2)
90.214	Transient Frequency Behavior	(Note 1)

SG-Sure Signal, **Model No.: SURE SIGNAL, SURE SIGNAL MAX, SURE SIGNAL CSR**, by **PowerLOC Technologies Inc.** has also been tested and found to comply with **FCC Part 15, Subpart B - Radio Receivers**. The engineering test report has been documented and kept in file and it is available anytime upon FCC request.

Note 1: Since there is no change on this FCC certified radio supplied by RIM, retest is not required.
Note 2: These tests needed to be performed since the transmitter antenna is not one of the antenna used in the original FCC certified radio FCC ID: L6AR902M-2-O

EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 8 of this report

6.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3. MEASUREMENT EQUIPMENT USED:

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4:1992 and CISPR 16-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER:

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

6.5. RF POWER OUTPUT @ FCC 2.1046 & 90.205

6.5.1. Limits @ FCC 90.205

Please refer to FCC CFR 47, Part 90, Subpart I, Para. 90.205 for specification details.

6.5.2. Method of Measurements

FCC @ 2.1046 – The rf output power of the transmitter was measured at the RF output terminals when the transmitter is adjusted by the manufacturer in accordance with the tune-up procedure to give the values of the current and voltage on the circuit elements specified in 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals were 50 Ohms.

The detailed test method is as follows:

- *The transmitter terminal was coupled to the Power Meter through a 20 dB attenuator*
- *Power of the transmitter channel near the lowest and highest of each frequency block/band were measured using the power meter, and the reading was corrected by added the calibrated attenuator's attenuation value and cable loss.*
- *The RF Output was turned on with standard modulation applied.*

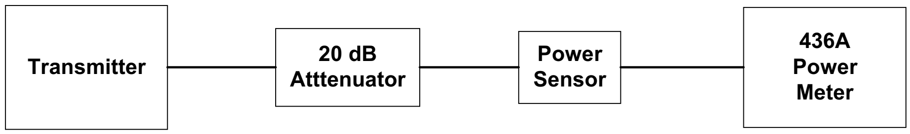
For ERP test method, refer to section 8.1 of this test report for details

6.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Power Meter	Hewlett Packard	436A	1725A02249	10 kHz – 50 GHz, sensor dependent
Power Sensor	Hewlett Packard	8481A	2702A68983	10 MHz – 18 GHz
Attenuator(s)	Bird	…	…	DC – 22 GHz
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz – 26.5 GHz
Attenuator(s)	Weinschel Corp	24-20-34	BJ2357	DC – 8.5 GHz
Dipole Antenna	EMCO	3121C	8907-440	30 MHz – 1 GHz
Dipole Antenna	EMCO	3121C	8907-434	30 MHz – 1 GHz
Synthesized RF Signal Generator	Gigatronic	6061A	5130408	10kHz – 1050 MHz

6.5.4. Test Arrangement

Power at RF Power Output Terminals



For ERP test arrangement, refer to section 8.1 of this test report for details

6.5.5. Test Data

Remark: EUT's antenna gain is 3 dBi max.

Conducted Power

Frequency (MHz)	Peak Conducted Power (dBm)
896	33.0
901	33.0

ERP Using Substitution Method

Frequency (MHz)	Peak E-Field @ 3m (dBμV/m)	Antenna Polarization (V/H)	Peak Power From Signal GEN. Ps (dBm)	Substitution Antenna Gain Gd (dBi)	Measured Peak ERP = Ps+Gd-2.15 (dBm)	Measured Peak EIRP = ERP+2.15 (dBm)
896	132.6	V	33.6	1.5	33.0	35.1
896	131.1	H	33.8	1.5	33.2	35.3
901	132.1	V	33.4	1.9	33.2	35.3
901	131.2	H	33.9	1.9	33.7	35.8

MPE EVALUATION

FCC 1.1310:- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Calculation Method of RF Safety Distance:

$$S = PG/4\Pi r^2 = EIRP/4\Pi r^2 \implies r = \sqrt{PG/4\Pi S} = \sqrt{EIRP/4\Pi S}$$

Where:
P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to center of radiation in cm

EIRP = 35.8 dBm = 3802 mW (max. eirp measured at 901 MHz)
S = 896/1500 mW/cm^2 (limits for general population/uncontrolled exposure)

$$r = \sqrt{EIRP/ 4\Pi S} = \sqrt{3802 / (4\Pi(896/1500))} = 22.5 \text{ cm}$$

The minimum safety distance is approximately 23 cm. In the user manual, RF exposure statement will specified a safety distance of 30 cm.

6.6. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS @ FCC 90.210

6.6.1. Limits @ FCC 90.210

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC RULES	WORST CASE EMISSIONS LIMIT	ATTENUATION LIMIT (dBc)
FCC 90.210 (b),(c)(g),(h),(i),(j),(k)	FCC 90.210 (j)	-20 dBm

6.6.2. Method of Measurements

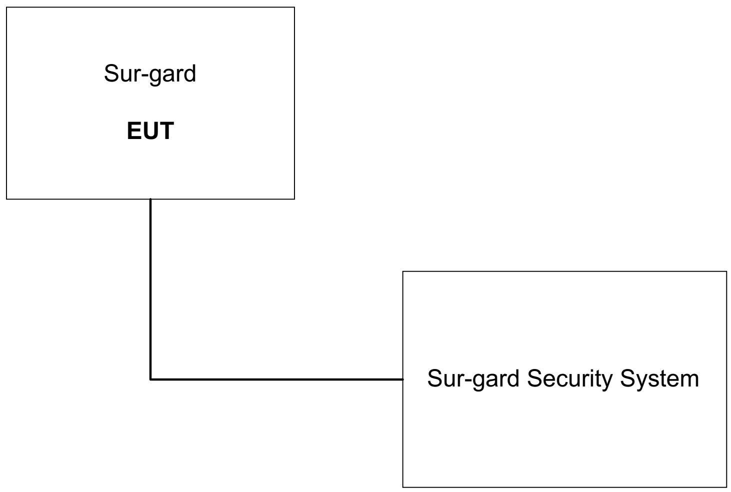
Refer to Exhibit 8, section 8.2 of this report and ANSI C63-4:1992 for radiated emissions test method.

6.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz to 32 GHz with external mixer for frequency above 32 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A	3116A00661	1 GHz to 26.5 GHz
Active Loop Antenna	EMCO	6507	8906-1167	1 kHz – 30 MHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna with Mixer	EMCO	3160-09	1007	18 GHz – 26.5 GHz
Horn Antenna with Mixer	EMCO	3160-10	1001	26.5 GHz – 40 GHz

6.6.4. Test Arrangement

The following drawings show details of the test setup for radiated emissions measurements



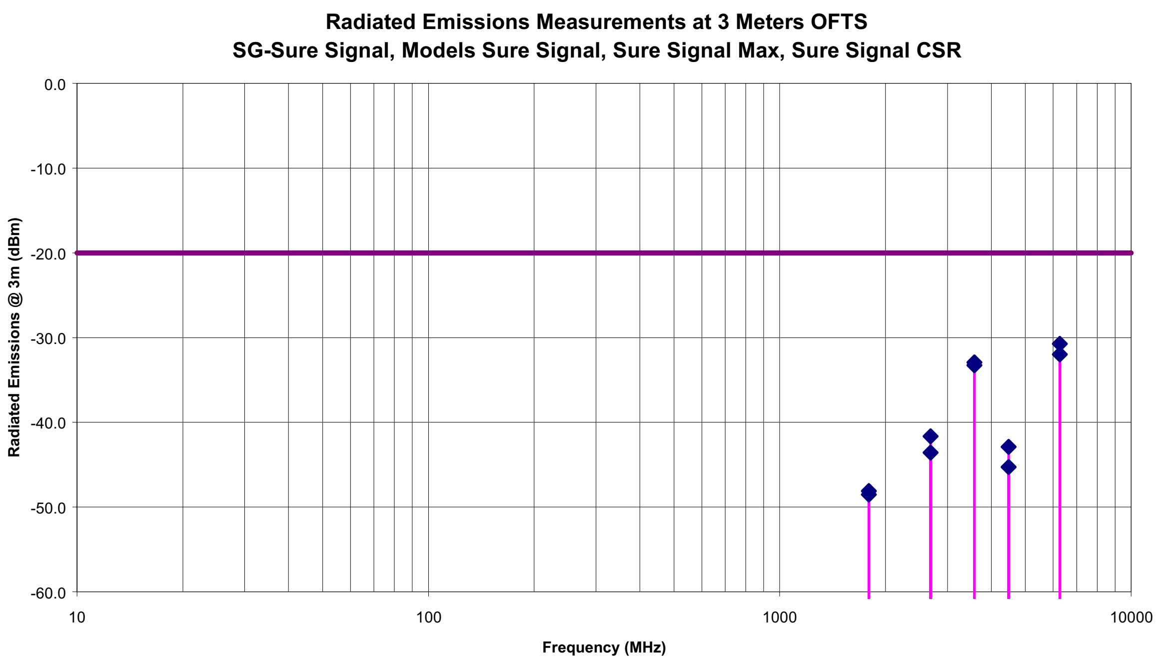
6.6.5. Test Data

6.6.5.1. Near Lowest Frequency (896 MHz)

Fundamental Frequency: 896 MHz
RF Output Power: 2 Watts

Frequency (MHz)	RF Field Strength Level (dBµV/m)	RF Power Level (dBm)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Limit (dBm)	Margin (dB)	Pass/Fail
1792	48.97	-48.5	Peak	V	-20.0	-28.5	Pass
1792	49.41	-48.1	Peak	H	-20.0	-28.1	Pass
2688	53.91	-43.6	Peak	V	-20.0	-23.6	Pass
2688	55.84	-41.7	Peak	H	-20.0	-21.7	Pass
3584	64.25	-33.3	Peak	V	-20.0	-13.3	Pass
3584	64.59	-32.9	Peak	H	-20.0	-12.9	Pass
4480	54.59	-42.9	Peak	V	-20.0	-22.9	Pass
4480	52.22	-45.3	Peak	H	-20.0	-25.3	Pass
6272	65.50	-32.0	Peak	V	-20.0	-12.0	Pass
6272	66.75	-30.8	Peak	H	-20.0	-10.8	Pass

The emissions were scanned from 10 MHz to 10 GHz and all emissions within 35 dB below the permissible limits were recorded.



6.6.5.2. *Near Highest Frequency (901 MHz)*

Fundamental Frequency: 901 MHz
RF Output Power: 2 Watts

Frequency (MHz)	RF Field Strength Level (dBµV/m)	RF Power Level (dBm)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Limit (dBm)	Margin (dB)	Pass/Fail
1802	48.94	-48.6	Peak	V	-20.0	-28.6	Pass
1802	45.38	-52.1	Peak	H	-20.0	-32.1	Pass
2703	55.53	-42.0	Peak	V	-20.0	-22.0	Pass
2703	54.72	-42.8	Peak	H	-20.0	-22.8	Pass
3604	65.13	-32.4	Peak	V	-20.0	-12.4	Pass
3604	61.63	-35.9	Peak	H	-20.0	-15.9	Pass
4505	55.56	-41.9	Peak	V	-20.0	-21.9	Pass
4505	52.50	-45.0	Peak	H	-20.0	-25.0	Pass
6307	64.34	-33.2	Peak	V	-20.0	-13.2	Pass
6307	61.78	-35.7	Peak	H	-20.0	-15.7	Pass
7208	59.09	-38.4	Peak	V	-20.0	-18.4	Pass
7208	56.47	-41.0	Peak	H	-20.0	-21.0	Pass

The emissions were scanned from 10 MHz to 10 GHz and all emissions within 35 dB below the permissible limits were recorded.

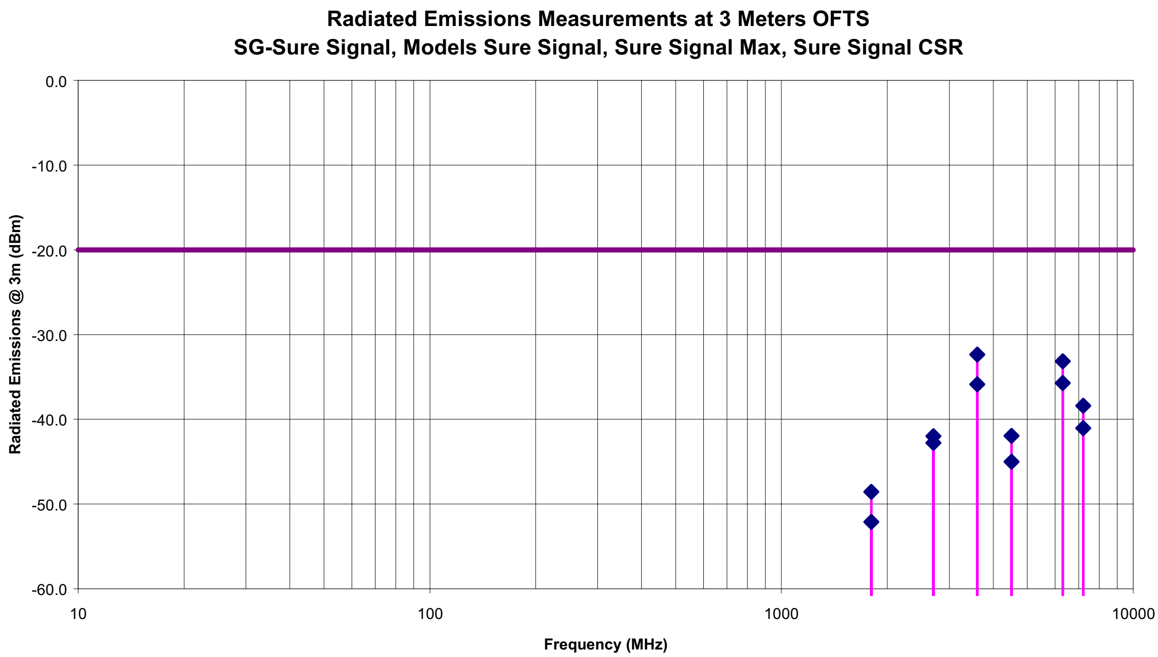


EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivit	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits $20Log(1\pm\Gamma_1\Gamma_R)$	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

EXHIBIT 8. MEASUREMENT METHODS

8.1. EFFECTIVE RADIATED POWER (ERP) MEASUREMENTS

- The following shall be applied to the combination(s) of the radio device and its intended antenna(e).
- I f the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.
- The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
- The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

Step 1: Duty Cycle measurements

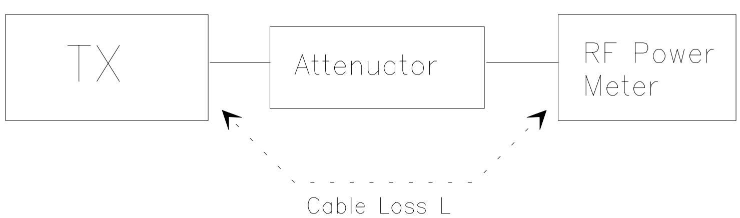
- Using a spectrum analyzer with the frequency span set to 0 Hz and the sweep time set at a suitable value to capture the envelope peaks and the duty cycle of the transmitter output signal;
- The duty cycle of the transmitter, x = Tx on / (Tx on + Tx off) with $0<x<1$, is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.

Step 2: Calculation of Average EIRP. See Figure 1

- The average output power of the transmitter shall be determined using a wideband, calibrated RF power meter with the power sensor with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be recorded as "A" (in dBm);
- The e.i.r.p. shall be calculated from the above measured power output "A", the observed duty cycle x, and the applicable antenna assembly gain "G" in dBi, according to the formula:

EIRP = A + G + 10log(1/x)

Figure 1.



Step 3: Substitution Method. See Figure 2

(a) The measurements was performed in the absence of modulation (un-modulated)
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The dipole test antenna was used and tuned to the transmitter carrier frequency.
(e) The spectrum analyzer was tuned to transmitter carrier frequency. The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(f) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(g) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.

(h) The substitution dipole antenna and the signal generator replaced the transmitter and antenna under test in the same position, and the substitution dipole antenna was placed in vertical polarization. The test dipole antenna was lowered or raised as necessary to ensure that the maximum signal is stilled received.

(i) The input signal to the substitution antenna was adjusted in level until an equal or a known related level to that detected from the transmitter was obtained in the test receiver. The maximum carrier radiated power is equal to the power supply by the generator.

(j) The substitution antenna gain and cable loss were added to the signal generator level for the corrected ERP level.

(k) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.

(l) Actual gain of the EUT's antenna is the difference of the measured ERP and measured RF power at the RF port. Correct the antenna gain if necessary.

Figure 2

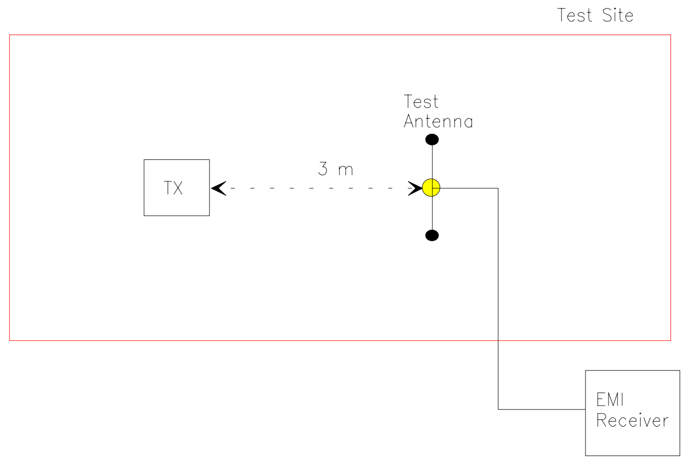
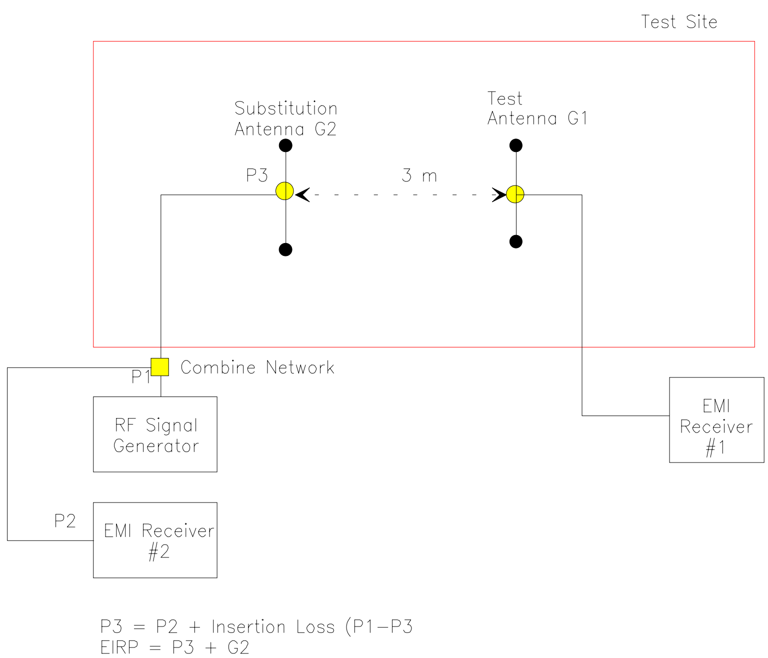


Figure 3



8.2. SPURIOUS EMISSIONS (RADIATED)

With transmitter modulation characteristics described in Out-of-Band Emissions measurements @ 2.989, the transmitter spurious and harmonic emissions were scanned. The spurious and harmonic emissions were measured with the Spectrum Analyzer controls set as RBW = 100 kHz minimum , VBW ≥ RBW and SWEEP TIME = AUTO). The transmitter was operated at a full rated power output, and modulated as follows:

FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated:- The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC CFR 47, Para. 2.993 - Field Strength Spurious Emissions

(a) Measurements was made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.989(c) as appropriate. For equipment operating on frequencies below 1 GHz , an Open Field Test is normally required, with the measuring instrument antenna located in the far field at all test frequencies. In event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

(b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
(2) All equipment operating on frequencies higher than 25 MHz
(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
(4) Other types of equipment as required, when deemed necessary by the Commission.

Maximizing RF Emission Level:

(a) The measurements was performed with standard modulation
(b) Test was performed at listed 3m open area test site (listed with FCC, IC, ITI, NVLAP, ACA & VCCI).
(c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
(d) The biconilog Antenna (20 MHz to 1 GHz) or Horn Antenna (1 GHz to 18 GHz) was used for measuring.
(e) The spectrum analyzer was tuned to transmitter carrier frequency. The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
(f) The transmitter was rotated through 360^{o} about a vertical axis until a higher maximum signal was received.
(g) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
(h) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.

(i) The field strength level measured at 3m is converted to the power in dBm by subtracting a constant factor of 97.5 dB

METHOD OF CALCULATION FOR TRANSMITTED POWER (P) FROM THE MEASURED FIELD STRENGTH LEVEL (E) :

According to IEC 801-3, the power density can be calculated as follows:

$S = P / (4xPIxD^2)$ Where:
- S: Power density in watts per square feet
- P: Transmitted power in watts
- PI: 13.1415
- D: Distance in meters

The power density S (W/m^2) and electric field E (V/m) is related by:

$$S = E^2/(120xPI)$$

Accordingly, the field intensity of isotropic radiator in free space can be expressed as follows:

$$E = (30xP)^{1/2}/D = 5.5x(P)^{1/2}/D$$

For Halfwave dipole antenna or other antennas correlated to dipole in direction of maximum radiation:

$$S = (1.64xP)/(4xPIxD^2)$$
$$E = (49.2xP)^{1/2}xD = 7.01x(P)^{1/2}/D$$

$$\boxed{P = (ExD/7.01)^2}$$

Calculation of transmitted power P (dBM) given a measured field intensity E (dBuV/m):

$$P(W) = [E(V/m)xD/7.01]^2$$
$$P(mW) = P(W)x1000$$
$$\Rightarrow P(dBm) = 10logP(mW)$$
$$= 20logE(V/m) + 20log(D) - 20log(7.01) + 10log1000$$
$$= E(dBV/m) + 20logD + 13$$
$$= E(dBuV/m) - 120 + 20log(D) + 13$$
$$= E(dBuV/m) + 20log(D) – 107$$

The Transmitted Power @ D = 3 Meters

P(dBm) = E(dBµV/m) - 97.5